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(54) Liquid detergent composition containing nonionic and ionic surfactants.

(57) Liquid detergent composition containing anionic, selected nonionic, and alkylpolysaccharide surfactants are disclosed. The nonionic surfactant is a drainage promoting ethoxylated substance. The liquid compositions herein can optionally contain suds stabilizing nonionic surfactants and detergency builders. The compositions of this invention are capable of promoting rapid and relatively complete drainage of rinse water.

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LIQUID DETERGENT COMPOSITION CONTAINING NONIONIC AND IONIC SURFACTANTS

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Technical Field and Background Art

The invention relates to aqueous high sudsing liquid detergent compositions containing specified amounts and types of surfactants especially useful in the washing of tableware, kitchenware and other hard surfaces.

The compositions of this invention provide more complete drainage of rinse water from surfaces such as glass, ceramics and metal, thereby reducing spotting and filming, particularly in a dishwashing procedure that involves drain drying without towel drying and polishing.

The performance of a detergent composition for cleaning glasses, dishes, and other articles with a normally shiny surface is evaluated by the consumer in terms of shine and the absence of filming, streaking, and spotting. The liquid dishwashing detergent compositions presently on the market are designed to remove the soils from glasses, dishes, and other tableware and kitchen utensils. The detergent solution and redeposited soil residues are normally removed from the washed articles by rinsing and optionally by towel drying the articles when they are still wet. If not rinsed and towel dried, these residues can dry upon the surfaces of the washed articles, leaving films, streaks, or spots.

Even when such articles are entirely clean but rinsed in plain water containing dissolved salts such as water hardness, spots and streaks can appear on the washed and rinsed surfaces upon evaporation of the water.

Towel drying of washed articles, e.g., glasses and dishes, immediately after removal from the washing and rinsing solution, is undesirable from the standpoints of convenience and hygiene. Therefore, it is common practice to put the washed or washed and rinsed articles aside for draining and air-drying. Consequently, the cleaning efficacy of the product used, which the housewife may have visually appreciated at the end of the

washing or rinsing cycle, is diminished due to the adherence f redeposited soil, residual dried detergent, and water hardness residues.

U.S. Patent 3,963,649, Spadini et al, discloses liquid detergent compositions containing a nonionic surfactant and a water-soluble gel-forming gelatin. These compositions are said to minimize filming, streaking and spotting of tableware and kitchen utensils. The essential nonionic surfactant may be a tertiary amine or phosphine oxide, an amide or a condensation product of ethylene oxide and an organic hydrophobic compound.

U.S. Patent 3,983,079, Spadini et al, discloses dishwashing detergent compositions said to have good rinse water draining characteristics. The compositions contain a water-soluble quaternary ammonium compound, a nonionic surfactant containing both ethylene oxide and propylene oxide and a sultaine or betaine zwitterionic surfactant.

U.S. Patent 4,144,201, Winterbotham et al, discloses liquid dishwashing detergent compositions containing soluble casein to improve drain-dry and mildness properties.

Belgium Patent 845,184 discloses liquid and granular dishwashing detergent compositions containing one or more specified classes of surfactants to ensure rapid drainage and provide a shiny surface.

European patent application 0 034 039, published 19.08.1981, discloses the drainage promoting nonionic surfactant disclosed hereinafter.

It is an object of the present invention to provide liquid detergent compositions and a process for dishwashing that promote rapid and relatively complete drainage of rinse water thereby reducing spotting and filming on surfaces such as glass, ceramics and metal.

There is a continuing need for compositions and methods which can be employed during dishwashing operations to improve the final dry appearance of washed and dried kitchen utensils and articles. If such compositions and methods are intended to

be useful f r conventional dishwashing soil removal operations, there is a continuing need for a compatible combination of materials which will simultaneously provide the surfactancy, sudsing, and mildness attributes of an acceptable dishwashing detergent composition as well as the anti-spotting and anti-filming benefits described above.

Summary of the Invention

The present invention comprises a liquid detergent composition containing by weight:

(a) from about 5% to about 50% of an anionic surfactant;

(b) from about ½% to about 20% of a drainage promoting nonionic surfactant selected from the group consisting of:

(i) an ethoxylated aliphatic alcohol of the formula $R(OC_2H_4)_nOH$ wherein R is an aliphatic hydrocarbyl radical containing from about 16 to about 30 carbon atoms, wherein n is from about 16 to about 100;

(ii) an ethoxylated alkyl phenol of the formula $R(OC_2H_4)_nOH$ wherein R is an alkyl phenyl radical containing a total of from about 18 to about 30 carbon atoms and at least one alkyl group containing at least about 12 carbon atoms wherein n is from about 16 to about 100;

(iii) the condensation product of mono C_{16-22} fatty acid esters of polyglycols with from about 13 to about 100 moles of ethylene oxide per mole of the mono-ester;

(iv) the condensation product of cholesterol and from about 13 to about 100 moles of ethylene oxide;

(v) a material which is a condensate of ethylene oxide, propylene oxide and a compound containing hydroxy or amine groups onto which alkylene oxides can be polymerized, said polymer having a

molecular weight of from about 500 to about 15,000, an ethylene oxide content of from about 30% to about 70% by weight and a propylene oxide content of from about 30% to about 70% by weight; and

(vi) mixtures thereof;

(c) from about ½% to about 30%, preferably from about 1% to about 20% of an alkylpolysaccharide surfactant having the formula $RO(R^1O)_tZ_x$ wherein Z is a moiety derived from a reducing saccharide containing from 5 to 6 carbon atoms, preferably a glucose, galactose, glucosyl, or galactosyl residue or mixtures thereof; R is a hydrophobic group selected from the group consisting of alkyl, alkyl phenyl, hydroxyalkyl phenyl or hydroxy alkyl groups or mixtures thereof in which said alkyl groups contain from about 8 to about 20 carbon atoms preferably from about 10 to about 16 carbon atoms, most preferably from about 12 to about 14 carbon atoms; R^1 contains from 2 to 4 carbon atoms, preferably ethylene, propylene and/or glyceryl, t is from 0 to about 30, preferably 0 to about 10, most preferably 0; wherein x is a number from about 1.5 to about 10, preferably 1.5 to 4, most preferably 1.6 to 2.7; and

(d) from about 0% to about 10% of a suds stabilizing non-ionic surfactant selected from the group consisting of amides, amine oxides and mixtures thereof;

(e) from 0% to about 10% of a detergency builder selected from inorganic phosphates, polyphosphates, silicates, and carbonates, organic carboxylates, phosphonates and mixtures thereof; and

(f) from about 20% to about 88% water.

In the process or method aspect of the invention, dishware, glassware, and other tableware and kitchenware are washed in water solutions of the detergent composition, generally at a weight concentration of about 0.05% to about 0.4% of the composition in water at a temperature of about 80°F (26.7°C) to

about 120°F (48.9°C). The tableware and kitchenware are then rinsed, drained, and allowed to dry in a rack or other means of separation.

Detailed Description of the Invention

The liquid detergent compositions of the present invention contain three essential components:

(a) an anionic surfactant

(b) a drainage promoting ethoxylated nonionic surfactant

(c) an alkyl polysaccharide surfactant, and

(d) water.

Optional ingredients can be added to provide various performance and aesthetic characteristics.

Anionic Surfactant

The compositions of this invention contain from about 5% to about 70% by weight of an anionic surfactant or mixtures thereof. Preferred compositions contain from about 10% to about 60% of anionic surfactant by weight.

Most anionic detergents can be broadly described as the water-soluble salts, particularly the alkali metal, alkaline earth metal, ammonium and amine salts, of organic sulfuric reaction products having in their molecular structure an alkyl radical containing from about 8 to about 22 carbon atoms and a radical selected from the group consisting of sulfonic acid and sulfuric acid ester radicals. Included in the term alkyl is the alkyl portion of acyl radicals. Examples of the anionic synthetic detergents which can form the surfactant component of the compositions of the present invention are the sodium, ammonium, potassium, lithium, or magnesium alkyl sulfates, especially those obtained by sulfating the higher alcohols (C_8-C_{18} carbon atoms) sodium or magnesium alkyl benzene or alkyl toluene sulfonates, in which the alkyl group contains from about 9 to about 15 carbon atoms, the alkyl radical being either a straight or branched aliphatic chain; sodium or magnesium paraffin sulfonates and olefin sulfonates in which the alkyl or alkenyl group contains from about 10 to about 20 carbon atoms; sodium C_{10-20} alkyl glyceryl ether sulfonates, especially those ethers of alcohols

derived from tallow and coconut oil; sodium coconut oil fatty acid monoglyceride sulfates and sulfonates; sodium, ammonium or magnesium salts of alkyl phenol ethylene oxide ether sulfates with about 1 to about 30 units of ethylene oxide per molecule and in which the alkyl radicals contain from 8 to about 12 carbon atoms; the reaction products of fatty acids esterified with isethionic acid and neutralized with sodium hydroxide where, for example, the fatty acids are derived from coconut oil; sodium or potassium salts of fatty acid amides of a methyl tauride in which the fatty acids, for example, are derived from coconut oil and sodium or potassium beta-acetoxy or beta-acetamido-alkanesulfonates where the alkane has from 8 to 22 carbon atoms.

Specific examples of preferred alkyl sulfate salts which can be employed in the instant detergent compositions include sodium lauryl alkyl sulfate, sodium stearyl alkyl sulfate, sodium palmityl alkyl sulfate, sodium decyl sulfate, sodium myristyl alkyl sulfate, potassium lauryl alkyl sulfate, potassium stearyl alkyl sulfate, potassium decyl sulfate, potassium palmityl alkyl sulfate, potassiulm myristyl alkyl sulfate, sodium dodecyl sulfate, magnesium dodecyl sulfate, potassium tallow alkyl sulfate, sodium tallow alkyl sulfate, sodium coconut alkyl sulfate, potassium coconut alkyl sulfate, magnesium C_{12-15} alkyl sulfate and mixtures of these surfactants. The corresponding ammonium alkyl sulfates are particularly desirable. Preferred alkyl sulfates include sodium C_{12-15} alkyl sulfates and magnesium C_{12-15} alkyl sulfate.

Suitable alkylbenzene or alkyltoluene sulfonates include the alkali metal (lithium, sodium, potassium), alkaline earth (calcium, magnesium) ammonium and alkanolamine salts of straight or branched chain alkylbenzene or alkyltoluene sulfonic acids. Alkylbenzene sulfonic acids useful as precursors for these surfactants include decyl benzene sulfonic acid, undecyl benzene sulfonic acid, dodecyl benzene sulfonic acid, tridecyl benzene sulfonic acid, tetrapropylene benzene sulfonic acid and mixtures thereof. Preferred sulfonic acids as precursors of the alkyl-benzene sulfonates useful for compositions herein ar those

in which the alkyl chain is linear and averages about 11 t 13 carbon atoms in length. Examples of commercially available alkyl benzene sulfonic acids useful in the present invention include Conoco SA 515 and SA 597 marketed by the Continental Oil Company and Calsoft LAS 99 marketed by the Pilot Chemical Company.

Particularly preferred anionic surfactants useful herein are olefin sulfonates containing from about 10 to about 20 carbon atoms. Particularly preferred olefin sulfonates contain low levels of 2-hydroxy sulfonates. Sodium, potassium, ammonium alkanolamine, and magnesium olefin sulfonates are preferred, especially in mixtures containing some magnesium.

Specific examples of alkyl ether sulfates of the present invention are sodium coconut alkyl triethylene glycol ether sulfate, magnesium C_{12-15} alkyl triethylene glycol ether sulfate, and sodium tallow alkyl hexaethylene glycol ether sulfate. Preferred alkyl ether sulfates are those comprising a mixture of individual compounds, said mixture having an average alkyl chain length of from about 12 to 16 carbon atoms and an average degree of ethoxylation of from about ½ to 12 moles of ethylene oxide.

Additional examples of anionic surfactants useful herein are the compounds which contain two anionic functional groups. These are referred to as dianionic surfactants. Suitable dianionic surfactants are the disulfonates, disulfates, or mixtures thereof which may be represented by the following formula:

$$R(SO_3)_2M_2, R_4)_2M_2, R_3)(SO_4)M_2$$

where R is an acyclic aliphatic hydrocarbyl group having 15 to 20 carbon atoms and M is a water-solubilizing cation, for example, the C_{15} to C_{20} disodium 1,2-alkyldisulfates, C_{15} to C_{20} dipotassium-1,2-alkyldisulfonates or disulfates, di-sodium 1,9-hexadecyl disulfates, C_{15} to C_{20} disodium 1,2-alkyldisulfonates, disodium 1,9-stearyldisulfates and 6,10-octadecyldisulfates.

Drainage Promoting Ethoxylated Nonionic Surfactant

The ethoxylated nonionic surfactants of the present invention are the condensation product of alcohols, alkyl phenols and other specified hydrophobic molecules with ethylene oxide. Preferably, the compositions of the present invention contain from about ¼% to about 20%, more preferably from about ½% to about 15%, and most preferably from about 3/4% to about 10%, of drainage promoting ethoxylated aliphatic alcohols of the formula

$R(OC_2H_4)_nOH$

wherein R is an aliphatic hydrocarbyl radical containing from about 16 to about 30 carbon atoms, wherein n is from about 16 to about 100.

Other ethoxylated nonionic surfactants at a level of from about ¼% to about 20% can provide the drainage promoting characteristics of ethoxylated alcohols, but are less desirable for reasons of biodegradability and effect on sudsing or cleaning performance. Examples of such alternate ethoxylated nonionic surfactants are:

(1) an ethoxylated alkyl phenol of the formula $R(OC_2H_4)_nOH$ wherein R is an alkyl phenyl radical containing a total of from about 18 to about 30 carbon atoms and at least one alkyl group containing at least about 12 carbon atoms wherein n is from about 16 to about 100;

2) the condensation product of mono C_{16-22} fatty acid esters of polyglycols with from about 13 to about 100 moles of ethylene oxide per mole of partial ester;

(3) the condensation product of cholesterol and from about 13 to about 100 moles of ethylene oxide;

(4) a material which is a condensate of ethylene oxide,

propylene oxide and a compound containing hydroxy or amine groups onto which the alkylene oxides can be polymerized, said polymer having a molecular weight of from about 500 to about 15,000, an ethylene oxide content of from about 30% to about 70% by weight and a propylene oxide content of from about 30% to about 70% by weight.

In a particularly preferred embodiment an aliphatic alcohol containing from about 16 to 22 carbon atoms is ethoxylated to an average degree of from about 18 to about 50 moles of ethylene oxide per mole of alcohol.

The Alkylpolysaccharide Surfactant

The alkylpolysaccharides are those having a hydrophobic group containing from about 8 to about 20 carbon atoms, preferably from about 10 to about 16 carbon atoms, most preferably from 12 to 14 carbon atoms, and a polysaccharide hydrophilic group containing from about 1.5 to about 10, preferably from about 1.5 to about 4, most preferably from 1.6 to 2.7 saccharide units (e.g., galactoside, glucoside, fructoside, glucosyl, fructosyl and/or galactosyl units). Mixtures of saccharide moieties may be used in the alkyl polysaccharide surfactants. The number x indicates the number of saccharide units in a particular alkylpolysaccharide surfactant. For a particular alkylpolysaccharide molecule x can only assume integral values. In any physical sample of alkylpolysaccharide surfactants there will in general be molecules having different x values. The physical sample can be characterized by the average value of x and this average value can assume non-integral values. In this specification the values of x are to be understood to be average values. The hydrophobic group (R) can be attached at the 2-, 3-, or 4-positions rather than at the 1-position, (thus giving e.g. a glucosyl or galactosyl as opposed to a glucoside r galactoside). However, attachment through the 1-position, i.e., glucosides, galactosides, fructosides, etc., is preferred. In the preferred product the additional saccharide

units are predominately attached to the previous saccharide unit's 2-position. Attachment through the 3-, 4-, and 6-positions can also occur.

Optionally and less desirably there can be a polyalkoxide chain joining the hydrophobic moiety (R) and the polysaccharide-chain. The preferred alkoxide moiety is ethoxide.

Typical hydrophobic groups include alkyl groups, either saturated or unsaturated, branched or unbranched containing from about 8 to about 20, preferably from about 10 to about 16 carbon atoms. Preferably, the alkyl group is a straight chain saturated alkyl group. The alkyl group can contain up to 3 hydroxy groups and/or the polyalkoxide chain can contain up to about 30, preferably less than 10, most preferably 0, alkoxide moieties.

Suitable alkyl polysaccharides are decyl, dodecyl, tetradecyl, hexadecyl, and octadecyl, di-, tri-, tetra-, penta-, and hexaglucosides, galactosides, lactosides, fructosides, fructosyls, lactosyls, glucosyls and/or galactosyls and mixtures thereof.

The alkylmonosaccharides are relatively less soluble in water than the higher alkylpolysaccharides. When used in admixture with alkylpolysaccharides, the alkylmonosaccharides are solubilized to some extent. The use of alkylmonosaccharides in admixture with alkylpolysaccharides is a preferred mode of carrying out the invention. Suitable mixtures include coconut alkyl, di-, tri-, tetra-, and pentaglucosides and tallow alkyl tetra-, penta-, and hexaglucosides.

The preferred alkyl polysaccharides are alkyl polyglucosides having the formula

$$R^2O(C_nH_{2n}O)_t(Z)_x$$

wherein Z is derived from glucose, R^2 is a hydrophobic group selected from the group consisting of alkyl, alkylphenyl, hydroxyalkyl, hydroxyalkylphenyl, and mixtures thereof in which said alkyl groups contain from about 10 to about 18, preferably from 12 to 14 carbon atoms; n is 2 or 3, preferably

2, t is from 0 t about 10, preferably 0; and x is from about 1.5 t about 8, preferably from about 1.5 to about 4, most preferably from 1.6 t 2.7. The prepare these compounds a long chain alcohol (R^2OH) can be reacted with glucose, in the presence of an acid catalyst to form the desired glucoside. Alternatively the alkylpolyglucosides can be prepared by a two step procedure in which a short chain alcohol (C_{1-6}) is reacted with glucose or a polyglucoside (x=2 to 4) to yield a short chain alkyl glucoside (x=2 to 4) which can in turn be reacted with a longer chain alcohol (R^2OH) to displace the short chain alcohol and obtain the desired alkylpolyglucoside. If this two step procedure is used, the short chain alkylglucoside content of the final alkylpolyglucoside material should be less than 50%, preferably less than 10%, more preferably less than 5%, most preferably 0% of the alkylpolyglucoside.

The amount of unreacted alcohol (the free fatty alcohol content) in the desired alkylpolysaccharide surfactant is preferably less than about 2%, more preferably less than about 0.5% by weight of the total of the alkyl polysaccharide plus unreacted alcohol. The amount of alkylmonosaccharide is about 20% to about 70%, preferably 25% to 60%, most preferably 30% to 50% by weight of the total of the alkylpolysaccharide. For some uses it is desirable to have the alkylmonosaccharide content less than about 10%.

As used herein, "alkylpolysaccharide surfactant" is intended to represent both the preferred glucose and galactose derived surfactants and the less preferred alkylpolysaccharide surfactants. Throughout this specification, "alkylpolyglucoside" is used to include alkylpolyglycosides because the stereo chemistry of the saccharide moiety is changed during the preparation reaction.

The amount of alkylpolysaccharide surfactant is from about 1% to about 20%, preferably from about 1% to about 20%, most preferably from about 2% to about 10%.

Suds Stabilizing Nonionic Surfactant

The compositions f this invention can contain from 0% to about 10%, preferably from about 1% to about 8%, of suds stabilizing nonionic surfactant or mixtures thereof having a

different chemical structure and function than the essential drainage promoting nonionic surfactant and a different chemical structure than the alkylpolysaccharide surfactant.

Suds stabilizing nonionic surfactants operable in the instant compositions are two basic types -- amides and the amine oxide semipolar nonionics.

The amide type of nonionic surface active agent include the ammonia, mono- and diisopropanol, and mono- and diethanol amides of fatty acids having an acyl moiety of from about 8 to about 18 carbon atoms and represented by the general formula

$$R^1\text{-}CO\text{-}N(H)_{m-1}(R^2OH)_{3-m}$$

wherein R^1 is a saturated or unsaturated, aliphatic hydrocarbon radical having from 7 to 21, preferably from 11 to 17 carbon atoms; R^2 represents a methylene or ethylene group; and m is 1, 2, or 3, preferably 1 or 2. Specific examples of said amides are mono-ethanol coconut fatty acid amide and diethanol dodecyl fatty acid amide. These acyl moieties may be derived from naturally occurring glycerides, e.g., coconut oil, palm oil, soybean oil and tallow, but can be derived synthetically, e.g., by the oxidation of petroleum, or hydrogenation of carbon monoxide by the Fischer-Tropsch process. The monoethanol amides and diethanolamides of C_{12-14} fatty acids are preferred.

Amine oxide semi-polar nonionic surface active agents comprise compounds and mixtures of compounds having the formula:

$$R^1(C_2H_4O)_n\overset{R^2}{\underset{R^3}{N}}\rightarrow O$$

wherein R^1 is an alkyl, 2-hydroxyalkyl, 3-hydroxyalkyl, or 3-alkoxy-2-hydroxypropyl radical in which the alkyl and alkoxy, respectively, contain from about 8 to about 18 carbon atoms, R^2 and R^3 are methyl, ethyl, propyl, isopropyl, 2-hydroxyethyl, 2-hydroxypropyl, or 3-hydroxypropyl and n is from 0 to about 10. Particularly preferred are amine oxides of the formula:

$$R^1 - \overset{R^2}{\underset{R^3}{N}}\rightarrow O$$

wherein R^1 is a C_{10-14} alkyl and R^2 and R^3 are methyl or ethyl.

The preferred sudsing characteristics of the compositions of the invention are those which will provide the user of the product with an indication of cleaning potential in a dishwashing solution. Soils encountered in dishwashing act as suds depressants and the presence or absence of suds from the surface of a dishwashing solution is a convenient guide to product usage. Mixtures of anionic surfactants and suds stabilizing nonionic surfactants are utilized in the compositions of the invention because of their high sudsing characteristics, their suds stability in the presence of food soils and their ability to indicate accurately an adequate level of product usage in the presence of soil. Additionally, and most importantly, compositions containing the other two essential surfactants of the invention but not the suds stabilizing nonionic surfactants as defined herein, do not provide an optimum draining promoting effect.

In preferred embodiments of the invention, the ratio of anionic surfactants to total nonionic surfactants in the composition will be in a molar ratio of from about 11:1 to about 1:1, and more preferably from about 8:1 to about 2:1. From the standpoint of sudsing, the suds stabilizing nonionic surfactants are generally preferred, but the essential relatively highly ethoxylated drainage promoting nonionic surfactants of the invention can contribute to sudsing performance and are included in the calculation of ratios of anionic to nonionic surfactant.

Other Optional Surfactants

The compositions of the invention may contain optional surfactants such as ampholytic, zwitterionic and cationic surfactants.

Ampholytic surfactants can be broadly described as derivatives of aliphatic amines which contain a long chain of about 8 to 18 carbon atoms and an anionic water-solubilizing group, e.g., carboxy, sulfo r sulfate. Examples f compounds falling within this definition are sodium-3-dodecylamino propane sulfonate, and dodecyl dimethylammonium hexanoate.

Zwitterionic surface active agents operable in the instant composition are broadly described as internally-neutralized derivatives of aliphatic quaternary ammonium and phosphonium and tertiary sulfonium compounds in which the aliphatic radical can be straight chain or branched, and wherein one of the aliphatic substituents contains from about 8 to 18 carbon atoms and one contains an anionic water solubilizing group, e.g., carboxy, sulfo, sulfato, phosphato, or phosphono.

Cationic surfactants such as quaternary ammonium compounds can find optional use in the practice of the invention to the extent they are compatible with the other surfactants in the particular composition.

Water

The compositions of this invention contain from about 20% to about 88%, preferably from about 40% to about 70%, water.

Additional Optional Ingredients

The compositions of this invention can contain up to about 10%, by weight of detergency builders either of the organic or inorganic type. Examples of water-soluble inorganic builders which can be used, alone or in admixture with themselves and organic alkaline sequestrant builder salts, are alkali metal carbonates, phosphates, polyphosphates, and silicates. Specific examples of such salts are sodium tripolyphosphate, sodium carbonate, potassium carbonate, sodium pyrophosphate, potassium pyrophosphate, potassium tripolyphosphate, and sodium hexametaphosphate. Examples or organic builder salts which can be used alone, or in admixture with each other or with the preceding inorganic alkaline builder salts, are alkali metal polycarboxylates, e.g., water-soluble citrates such as sodium and potassium citrate, sodium and potassium tartrate, sodium and potassium ethylenediaminetetraacetate, sodium and potassium N-(2-hydroxyethyl)-ethylenediamine triacetates, sodium and potassium nitrilotriacetates (NTA) and sodium and potassium N-(2-hydroxyethyl)-nitrilodiacetates. Other organic detergency builders such as water-soluble phosphonates can find

use in the compositions of the invention. In general, however, detergency builders have limited value in dishwashing detergent compositions and use at levels above about 10% can restrict formulation flexibility in liquid compositions because of solubility and phase stability considerations.

Alcohols, such as ethyl alcohol, and hydrotropes, such as sodium and potassium toluene sulfonate, sodium and potassium xylene sulfonate, trisodium sulfosuccinate and related compounds (as disclosed in U.S. Patent 3,915,903, incorporated herein by reference) and urea, can be utilized in the interests of achieving a desired product phase stability and viscosity. Ethyl alcohol at a level of from about 3% to about 15% and potassium or sodium toluene, xylene or cumene sulfonate at a level of from about 1% to about 6% are particularly useful in the compositions of the invention.

The detergent compositions of this invention can contain, if desired, any of the usual adjuvants, diluents and additives, for example, perfumes, enzymes, dyes, antitarnishing agents, antimicrobial agents, and the like, without detracting from the advantageous properties of the compositions. Alkalinity sources and pH buffering agents such as monoethanolamine, triethanolamine and alkali metal hydroxides can also be utilized.

The following examples are given to illustrate the compositions of the invention. All percentages, parts and ratios are by weight unless otherwise indicated.

EXAMPLE I

The following liquid detergent compositions were prepared and compared to a typical premium commercial product control.

Composition	A	B	C
Component			
Magnesium coconut alkyl sulfate	11.5	11.5	11.5
Ammonium coconut alkyl sulfate	1.4	1.4	1.4
Magnesium C_{14-15} olefin sulfonate	7.0	7.0	7.0
C_{12} monoethanolamide	4.5	4.5	4.5
C_{12-13} alkylpolyglyc side (1.8-2)	3.7	1.0	3.7
Tallow alcoholpolyethoxylate (18)	3.3	3.3	1.0
Water and miscellaneous	Balance		

SPOTTING AND FILMING PERFORMANCE

"Libby" glasses were soiled with a fatty soil containing milk solids and washed in 115°F (46.1°C) water, rack dried, graded on a 1-10 scale (1 poorest, 10 best) for spotting and filming. The glasses were also given a technical overall appearance grade by averaging the spotting and filming grades.

Average Conditions - 0.25% soil and 7 grains/gallon water hardness measured as $CaCO_3$

Product	Spotting	Filming	Appearance
A	7.42	9.26	8.34
B	7.31	8.75	8.03
C	7.16	8.94	8.05
Control	6.70	8.58	7.64
$LSD_{0.05}$	0.45	0.57	0.36

EXAMPLE II

Composition	D	E
Component		
NH_4 C_{12} alkylbenzene sulfonate	17.5	17.5
Magnesium C_{12} alkylbenzene sulfonate	6.4	6.4
NH_4 C_{12-13} alkylpolyethoxylate (0.8) sulfate	6.1	6.1
C_{12-13} alkylpolyglycoside (1.8-2)	5.0	5.0
Tallowalcoholpolyethoxylate(18)	-	3.3
Water and Miscellaneous	Balance	Balance

Product	Spotting	Filming	Appearance
D	6.56	8.34	7.45
E	7.06	8.75	7.90
Control	6.94	8.63	7.78

EXAMPLE III

Composition	F	G
Component		
Magnesium coconut alkyl sulfate	11.5	11.5
Ammonium coconut alkyl sulfate	1.4	1.4
Magnesium C_{14-15} olefin sulfonate	7.0	7.0
C_{12} monoethanolamide	4.5	4.5
C_{12-13} alkylpolyglycoside (1.8-2)	3.7	2.4
TAE_{18}	0.0	2.2

Product	Spotting	Filming	Appearance
A	7.01	9.04	8.02
G	6.78	9.00	7.89
F	6.44	8.88	7.66
Control	6.19	8.13	7.16
LSD	0.49	0.55	0.37

As can be seen from the above Examples, formulas containing both the alkylpolyglycoside and the tallowalcoholpolyethoxylate give superior spotting, filming and appearance.

As can also be seen, compositions formulated with olefin sulfonates are preferred over those compositions formulated with alkyl benzene sulfonates. Furthermore, from a spotting/filming standpoint, it is clear that both the alkylpolysaccharide and the drainage promoting nonionic surfactant are required and that approximately equal amounts of both surfactants are preferred.

When in the above Example I, sodium coconut alkylpolyethoxylate (3) sulfate replaces the olefin sulfonate and C_{12} alkyldimethylamine oxide is substituted for the C_{12} monoethanolamide, comparable results are obtained.

The following materials are substituted for the tallow alcohol polyethoxylate (18) in Compositions A-E:

1. C_{13-15} alkyl phenol-ethoxylate (30)
2. cholesterol-ethoxylate (24)
3. sorbitan monoleate-ethoxylate (80)
4. glyceryl monostearate-ethoxylate (20)
5. C_{12} alkanol-ethoxylate (20)
6. C_{18} alkanol-ethoxylate (20)

Comparable sudsing, appearance, filming and spotting performances are obtained.

CLAIMS

1. A liquid detergent composition comprising:
   (a) from about 5% to about 50% by weight of an anionic surfactant;
   (b) from about ½% to about 20% of a drainage promoting nonionic surfactant selected from the group consisting of:
      (i) an ethoxylated aliphatic alcohol of the formula $R(OC_2H_4)_nOH$ wherein R is an aliphatic hydrocarbyl radical containing from about 16 to about 30 carbon atoms, wherein n is from about 16 to about 100;
      (ii) an ethoxylated alkyl phenol of the formula $R(OC_2H_4)_nOH$ wherein R is an alkyl phenyl radical containing a total of from about 18 to about 30 carbon atoms and at least one alkyl group containing at least about 12 carbon atoms wherein n is from about 16 to about 100;
      (iii) the condensation product of mono C_{16-22} fatty acid esters of polyglycols with from about 13 to about 100 moles of ethylene oxide per mole of the mono-ester;
      (iv) the condensation product of cholesterol and from about 13 to about 100 moles of ethylene oxide;
      (v) a material which is a condensate of ethylene oxide, propylene oxide and a compound containing hydroxy or amine groups onto which alkylene oxides can be polymerized, said polymer having a molecular weight of from about 500 to about 15,000, an ethylene oxide content of from about 30% to about 70% by weight and a propylene oxide content of from about 30% to about 70% by weight; and
      (vi) mixtures thereof;
   (c) from about ½% to about 30% of an alkylpolysaccharide surfactant having the f rmula $RO(R^1O)_t(Z)_x$ where Z is

a moiety derived from a reducing saccharide c ntaining from 5 to 6 carbon atoms and wherein R is a hydrophobic group selected from the group consisting of alkyl, alkylphenyl, hydroxyalkylphenyl or hydroxyalkyl groups or mixtures thereof in which said alkyl groups contain from about 8 to about 20 carbon atoms; t is from 0 to about 30; and x is a number from about 1.5 to about 10;

(d) from about 0% to about 10% of a suds stabilizing nonionic surfactant selected from the group consisting of amine oxides, amides and mixtures thereof;

(e) from 0% to about 10% of a detergency builder selected from inorganic phosphates, polyphosphates, silicates, and carbonates, organic carboxylates, phosphonates and mixtures thereof; and

(f) from about 20% to about 88% water.

2. The composition of Claim 1 wherein the drainage promoting nonionic surfactant is an ethoxylated aliphatic alcohol.

3. The composition of Claim 2 wherein the molar ratio of anionic surfactant to total nonionic surfactant is from about 11:1 to about 1:1.

4. The composition of Claim 3 comprising from about 1% to about 8% of a suds stabilizing nonionic surfactant selected from the group consisting of dimethyl C_{12-14} alkylamine oxides, C_{12-14} alkyl ethanolamides and mixtures thereof.

5. The composition of Claim 4 wherein the anionic surfactant comprises a material selected from the group consisting of alkyl sulfates, alkyl ethoxy ether sulfates, alkyl benzene sulfonates, paraffin sulfonates, olefin sulfonates and mixtures thereof and said anionic surfactant is from about 10% t about 35% by weight of said composition.

6. The composition of Claim 1 wherein the x is from about 1.5 to about 4.

7. The composition of Claim 6 wherein x is from about 1.6 to about 2.7.

8. The composition of Claims 2, 3, 4, 5, 6, or 7 wherein the drainage promoting nonionic surfactant comprises an ethoxylated aliphatic alcohol of the formula $R(OC_2H_4)_nOH$ wherein R is an aliphatic hydrocarbyl radical containing from about 16 to about 22 carbon atoms and wherein n is from about 18 to about 50.

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European Patent Office

EUROPEAN SEARCH REPORT

Application number

EP 83 20 1373

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)
P,X	EP-A-0 075 995 (PROCTER & GAMBLE CO.) * Page 17, lines 13-23; claims 1, 4, 7-9 *	1,2,5, 8	C 11 D 3/22 C 11 D 1/66 C 11 D 1/83
D,A	EP-A-0 034 039 (PROCTER & GAMBLE CO.) * Claims 1-4 *		
A	US-A-3 721 633 (H.J. RANAUTO) * Claims 1, 2 *		

TECHNICAL FIELDS SEARCHED (Int. Cl. ³)

C 11 D 1/00
C 11 D 3/00

11, 21

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
BERLIN	05-12-1983	SCHULTZE D

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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A : technological background
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